

Orbit

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Roger Hill, Editor

Wow, do we have a packed May coming up.

First off is a transit of Mercury. For those of you who have never seen a transit before, I hope you enjoy the event. For many of us, work will get in the way (as it will with me), but I urge you to try to get a look at it as these events are rare enough that you get few chances in your lifetime of seeing one. Most of them occur in November, which is our cloudiest month. When you add in that not all of them will be visible from here because the Sun won't be up, then you have a type of event you only get a couple of shots at in your lifetime.

For those of you who are hoping for a repeat of the 2004 and 2012 transits of Venus, you'll have to remember that Mercury will only appear to be about 10 arc-seconds across...about 1/6th the apparent size of Venus during transits. It will look like a small, round sunspot as it moves across the face of the Sun.

I hope we all get a chance to view it. Lastly (on this topic, anyway), if you have the day off, which I don't, I urge you to get in touch with Ed Mizzi and help out with the public outreach event he's planning.

A few days later, the 2nd Annual Victorian Star Party will take place at Westfield Pioneer Village. I was at the one last year, which was a lot of fun. I took my Personal Solar Telescope and was able to show people an unusual brush prominence. Once the Sun had set, I put my 6" RC on the mount and used the Centre's iOptron cell phone adapters to allow people to get a movie of the Moon through a telescope. It was definitely a big hit, and I plan on doing the exact same thing this year.

We could use a few more people, though, so if you have a portable telescope, please bring it along. You'll need to be set up by shortly after 6pm, because they don't allow cars on the Village grounds when it's open to the public. If you don't have a portable telescope, we can set you up with one, or just bring a pair of binoculars. The Moon will be the big hit that evening, along with Jupiter. There is also a possibility that Mars will be visible, too, before the park closes at 10pm, but it will be quite low, and not the best view.

Also coming in May is the combined AstroCATS and the RASC General Assembly in London, as well as the inaugural Canadian AstroPhotography School. This is one of the years when I really curse my schedule, because I will be working that entire weekend, and the days leading up to it, so for the second year in a row, I won't be able to make it. Not that I have much money left after my trip to Chile in March, but still...I would have liked to be there. I'm looking forward to hearing all about all the events, though, so I hope there will be lots of coverage in the next issue of Orbit.

Sometimes life interferes with our astronomical pursuits. I was able to attend the March meeting, but had to miss the April one due to work. I was in Chile when the March Board meeting was to have taken place. It had to be cancelled, though because too many of us were scattered around the planet. If memory serves, Andy Blanchard was in Australia, and Gary Bennett was in Hawai'i (Life is tough at times, eh?). In April, it turned out that I had to work the night of the General meeting, and then my wife, son and I had second row seats for the musical "Once" in Kitchener. So several things have conspired to keep me from attending Hamilton Centre events for almost two months...which is why I'm really looking forward to this months meetings and events!

Clear skies, to one and all!

Roger

Who wants to do some star gazing? - Gary Bennett

We have an impressive number of fun events coming up between now and early July and we know you will want to be part of it!

The Board of Directors has been very busy working on the 5 year plan that we announced a few months ago. We now have a formal outreach program that is guaranteed to be a ton of fun. Those events include:

Westfield Heritage Village - Star Party where our club antique telescopes are on display. A few time a year we get to bring them out of storage and use them for some actual star gazing. On May 13 Westfield is having their public Star Party and we will be there to share this wonderful hobby with people who are looking through a telescope for the first time.

Royal Botanical Gardens has 7 evening events between May 7 and July 9 and we are part of the entertainment. Club volunteers get in FREE but everyone else has to pay \$ 40.00 to be there!

Transit of Mercury happens on May 9 and member Ed Mizzi has organized a fun day to celebrate this rare event

We need volunteers to help man the telescopes at these events and we can't think of a better way to share this wonderful hobby with the public. Not only is it a heap of fun, you'll feel good about helping out too.

Beginners are especially welcome volunteers, so don't be shy. The public will ask some questions that you might not know the answer to but they like to hear that you joined an astronomy club because you want to learn more. Some experienced astronomers will be there to make you feel welcome We'll arm you with some fun facts to share with the public and you will come away feeling like an expert.

To learn more about these fun activities (and sign-up to volunteer), visit:
<http://www.hamiltonrasc.ca/programs/all-it-takes-is-a-smile-and-a-telescope/>

Oh, and don't forget, AstoCATS/CAPS:

- CAPS Astrophotography School : May 19 & 20
- AstroCATS / RASC General Assembly: May 21 & 22

<http://www.astrocats.ca/>

Thank you, Mark Pickett, from Roger Hill

Mark Pickett has decided to step down from the Board of Directors, and will be leaving the Hamilton Centre.

I, for one, would like to thank Mark for his passion, energy and countless hours he has devoted to the Good of the Centre. In particular, his efforts towards Public Outreach, our Loaner Telescope program, our National Rep., all his efforts at Westfield, and the outdoor observing component at AstroCATS.

For several years now, Mark has been incredibly diligent about doing Sidewalk Astronomy. He helped me out on numerous occasions, from back in the days when we were doing the series of seminars down at Spencer Smith Park in Burlington, right through the recent NOVA program. I wish I could have helped him out more often than I did, but my crazy work schedule frequently stopped me.

We also shared a common interest in different telescope designs, and while he disliked the Schmidt-Cassegrain, I admired it as the almost perfect compromise.

Thanks for all you've done, Mark...I'll miss you. And yes, I still owe you a beer!

2016 TRANSIT OF MERCURY BY FRED ESPENAK

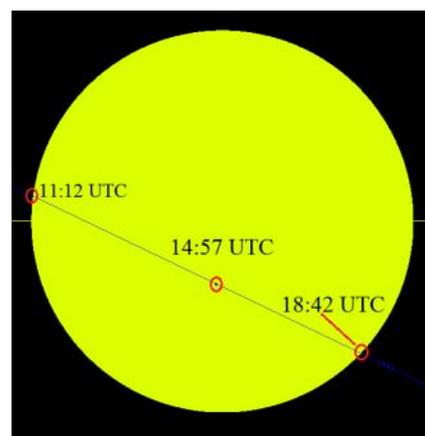
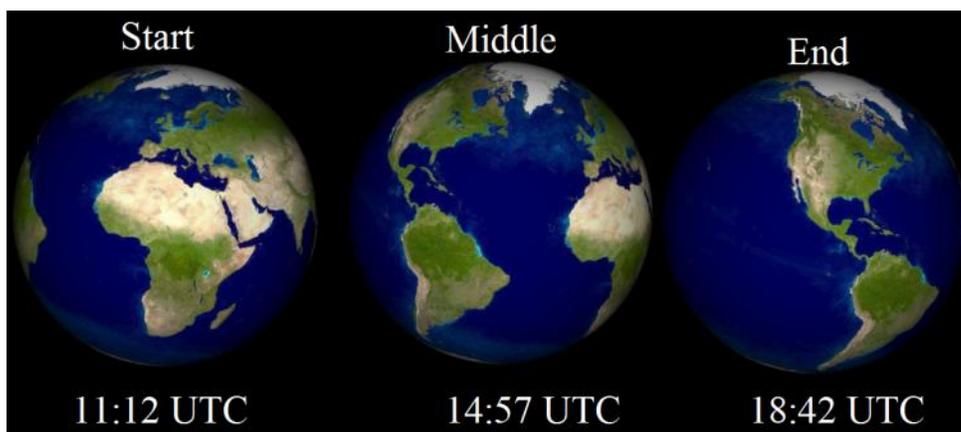
On Monday, 2016 May 09, Mercury will transit the Sun for the first time since 2006. The transit or passage of a planet across the face of the Sun is a relatively rare occurrence. As seen from Earth, only transits of Mercury and Venus are possible. There are approximately 13 transits of Mercury each century. In comparison, transits of Venus occur in pairs with more than a century separating each pair.

The principal events occurring during a transit are conveniently characterized by contacts, analogous to the contacts of an annular solar eclipse. The transit begins with contact I, which is the instant when the planet's disk is externally tangent to the Sun. Shortly after contact I, the planet can be seen as a small notch along the solar limb. The entire disk of the planet is first seen at contact II when the planet is internally tangent to the Sun. During the next several hours, the silhouetted planet slowly traverses the brilliant solar disk. At contact III, the planet reaches the opposite limb and once again is internally tangent to the Sun. Finally, the transit ends at contact IV when the planet's limb is externally tangent to the Sun. Contacts I and II define the phase called ingress while contacts III and IV are known as egress. Position angles for Mercury at each contact are measured counter clockwise from the north point on the Sun's disk.

TABLE 1: GEOCENTRIC PHASES OF THE 2016 TRANSIT OF MERCURY

EVENT	UNIVERSAL TIME	POSITION ANGLE
CONTACT I	11:12:19	83.2°
CONTACT II	11:15:31	83.5°
GREATEST TRANSIT	14:57:26	153.8°
CONTACT III	18:39:14	224.1°
CONTACT IV	18:42:26	224.4°

Table 1 gives the times of major events during the 2016 transit in Universal Time (UT1). Greatest transit is the instant when Mercury passes closest to the Sun's center (i.e., minimum separation). At this time, the geocentric angular distance between the center's of Mercury and the Sun will be 318.5 arc-seconds. The position angle is the direction of Mercury with respect to the center of the Sun's disk as measured counter clockwise from the celestial north point on the Sun.



Since Mercury is only 1/158 of the Sun's apparent diameter, a telescope with a magnification of 50x or more is recommended to watch this event. The telescope must be suitably equipped with adequate filtration to ensure safe solar viewing. The visual and photographic requirements for the transit are identical to those for observing sunspots and partial solar eclipses. Amateurs can make a useful contribution by timing the four contacts at ingress and egress. Observing techniques and timing equipment are similar to those used for lunar occultations. Since poor seeing often increases the uncertainty in contact timings, an estimate of the possible error associated with each time should be included. Transit timings and geographic coordinates of the observing site (measured from GPS) should be sent to Dr. John E. Westfall (johnwestfall@comcast.net), A.L.P.O. Mercury/Venus Transit Section, 5061 Carbondale Way, Antioch, CA 94531.

White light observations of contacts I and IV include a small bias since Mercury is only visible after contact I and before contact IV. However, if Hydrogen-alpha filtration is available, the planet may be visible against either prominences or the chromosphere before and after contacts I and IV respectively. Observations of contacts II and III also require amplification. They're often mistaken for the instant when the planet appears internally tangent to the Sun. However, just before contact II, the so-called black drop effect is seen. At that time, the transiting planet seems to be attached to the Sun's limb by a thin column or thread. When the thread breaks and the planet is completely surrounded by sunlight, this marks the true instant of contact II. Contact III occurs in exactly the reverse order. Atmospheric seeing often makes it difficult to measure contact timings with a precision better than several seconds.

Transit of Mercury—Hamilton Centre plans

Volunteers needed for this momentous event. Ed Mizzi is looking for help with this great Outreach opportunity, so let's get straight to the details.

- * Date: Monday, May 9, 2016 Times: 07:13 – 14.41 Classes begin at 09:00
- * Location: Canadian Martyrs' Elementary School, Burlington, ON.
- * Audience: Students from grades 5 to 8 and their teachers, plus any passersby.

Additional details:

- * Ed will have 2 of the club's Dobs, with Solar Filters (thanks to Gary Bennett), at the site, but we could use more telescopes. Ed will be there all day, if necessary.
- * The students will have already been briefed about the event but be prepared with a short description of what is happening and its significance (links below).
- * Volunteers are not, of course, expected to stay for the entire event. Even an hour of your time would be appreciated.
- * Parking is available. Please see link below.
- Please contact Ed.Mizzi, via the Forum or directly at edmizzi.mizzi@gmail.com, if you are interested in helping. Thanks.

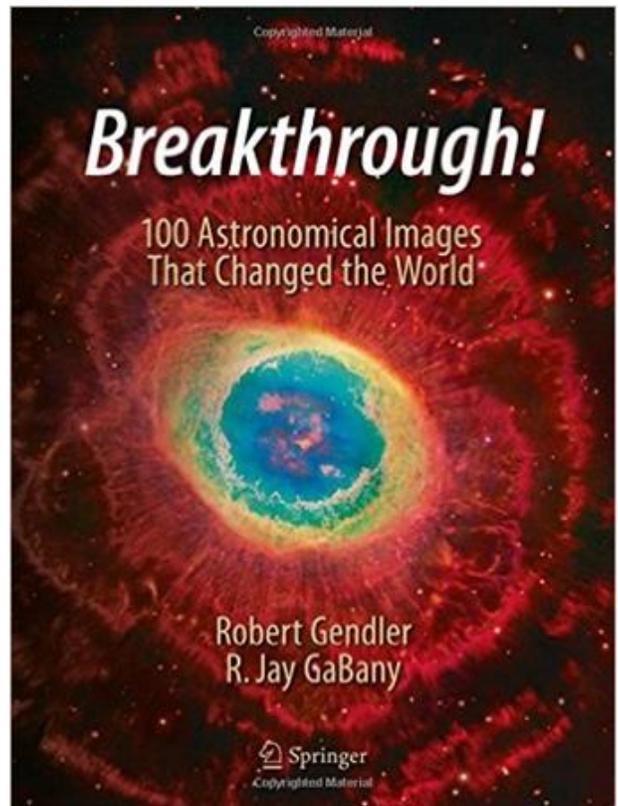
Transit Information:

<http://eclipsewise.com/oh/tm2016.html> and
<http://eclipsewise.com/oh/oh-tables/tm2016-Tab02b.pdf>

Librarian's Report for May 2016

by Chris Talpas

Although the first telescopes were in use by 1609, it wasn't until shortly after the invention of the camera in 1839 that the first photograph of an astronomical body, the moon, was made in 1840. Until that time, only the eye, paper and writing instruments were all that was available to record the wonders of the heavens. Well known amateur imagers Robert Gendler (www.robgendlerastropics.com) and R. Jay GaBany (www.cosmotography.com) have produced a book that chronicles the development of astronomical imaging from 1840 to the present time by choosing 100 significant astro images. As the authors indicate, "this book pays homage to these ground breaking milestones of imaging by presenting 100 of the most extraordinary examples with the unique human and scientific stories that accompany them. Many images included in this book were chosen for their historical scientific importance, but some were also selected because of their ability to convey the majesty and wonder of the cosmos and by virtue of that quality have been elevated to an iconic status embedded within the collective consciousness of the public".



At 171 pages and measuring 21.2 x 1.7 x 29.2 cm, this book was published in November 2015, so it is quite up to date and is available from Amazon for \$45.50. The first chapter which is purely text traces the technological development of astrophotography from film through photomultipliers and CCD. It looks at developments of the telescope during that time both on earth and via the Hubble out in space. It also traces expansion of imaging wavelengths from visible into the infrared to ultraviolet and x-ray as well as radiowaves. This chapter provides the reader with a good high level overview of the topics to be covered in the subsequent chapters.

The second chapter "A Series of Firsts, from Daguerreotypes to Dry Plates" traces the birth of astrophotography and the earliest attempts at images celestial objects. With the limitations of the available technology, the moon and sun were the earliest subjects but as sensitivity increased, the bright planets Jupiter and Saturn as well as some brighter stars came into reach. This era was also the beginning of Astrometry, stellar spectroscopy, and saw the discovery of the Cepheid variables as a stellar yardstick. Photographically gathered spectral data also provided the basis of luminosity to spectral class relationship discovered by Hertzsprung and Russell.

Chapter 3 "The Photographic Exploration of Deep Space and the Realm of the Nebula" traces the development of the deep sky era that was initially pioneered by amateur astronomer Andrew Common. Important objects that are discussed include the Orion nebula, the Magellanic Clouds, the Andromeda Galaxy and our own Milky way. Edward Barnard's famous work featuring 500 photographic plates of the Milky way is discussed including the important plate showing the existence of dark nebula. The adoption of photography by professional astronomers is chronicled and the ground breaking work of Hubble in demonstrating that the Andromeda nebula is actually a distinct galaxy and that the universe is expanding via redshifts is used to highlight this. The chapter ends with a discussion on the invention of the Schmidt camera and it's usefulness for photographic surveys.

Chapter 4 covers the development of colour photography and the transition to electronic imaging. The first target of colour astrophotography was the Andromeda galaxy with nebula such as the Ring nebula and the Orion nebula soon following. In viewing the photographs one is struck by what required a 200 inch telescope in 1958 is exceeded by amateurs today with fairly modest equipment and modern CCD or CMOS detectors. The transition to electronic imaging begins with a capture of the full moon in 1974 and includes a number of important amateur images showing what is capable with this modern technology. The greatly improved sensitivity and linear response of the CCD also has enabled professionals to peer deep into the past.

Continued from Page 4

Chapter 5 discusses the most productive scientific instrument ever built, with contributions to more than 11,000 scientific papers, the Hubble Space Telescope which ushered in the era of satellite observatories. Iconic images such as the protoplanetary discs found in M42, the Eta Carinae nebula, the Shoemaker Levy 9 comet train, and most famous of all .."The pillars of creation" and deep field image are just a few of the many images included in this chapter. While the images will be quite familiar, the stories behind these images and their scientific importance are not always as familiar and this is what helps to make this book special.

Chapter 6 discusses the multiwavelength universe stretching across the electromagnetic spectrum including well known missions such as COBE, WMAP, Planck, Spitzer, Chandra, Galex, SDO, and CGRO. Remnants of the Big Bang as shown by the Cosmic Background Explorer and refined first by the Wilkinson Microwave Anisotropy Probe and then by Planck are discussed. The infrared portion of the spectrum, as imaged by the Spitzer space telescope is depicted with an image of the Helix nebula while the Crab nebula provides the subject for Chandra's x-ray detectors. Composite images using data from Hubble, Chandra and Spitzer are also shown and discussed. Much closer to home, our Sun is featured during the discussion of the Solar Dynamic Observatory.



Chapter 7 covers the other worlds of our solar system imaged by both manned and robotic spacecraft. The chapter begins with our brief glimpse at the hellish surface of Venus captured by Venara 9 and 10 followed by our first look at the rocky surface of Mars via Viking 1. This chapter also includes the beautiful and famous Earthrise over the lunar surface captured by Apollo 8 astronaut William Anders as well as the footprint of Neil Armstrong. The photo of the far side of the moon provided by the Russian probe Luna 3 in 1959 is also included as are images of Jupiter and Saturn by the Voyager probes. The famous Martian blueberries (actually Hematite spherules) as photographed by rover Opportunity also makes the cut.

This book is both interesting and an easy read with each picture and vignette taking up a page or two. It succeeds in telling the story of our progress in both technology to explore and the resulting understanding of the marvelous and awe inspiring Cosmos that we live in.

The image of M31, above, is a 120 minute exposure made on August 11, 1958 using the Palomar 48-inch Schmidt telescope (now the Samuel Oschin Schmidt) by Mount Wilson and Palomar observatories' William C. Miller. Miller used the then revolutionary super ansco reversal film, which had a nominal speed of 100 ASA. The image was digitally remastered by David Malin from the Original plates made by Miller. It is Figure 4.1, and can be found on page 50 of the book.

Hubble Shatters The Cosmic Record For Most Distant Galaxy

By Ethan Siegel

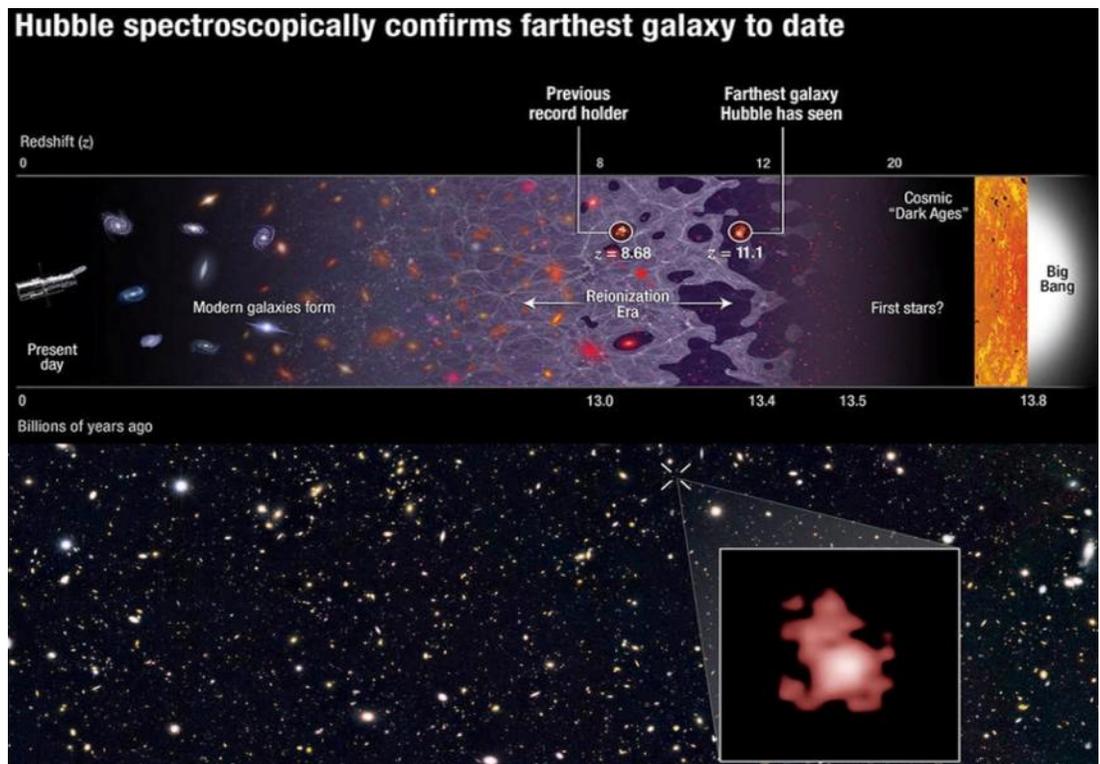


The farther away you look in the distant universe, the harder it is to see what's out there. This isn't simply because more distant objects appear fainter, although that's true. It isn't because the universe is expanding, and so the light has farther to go before it reaches you, although that's true, too. The reality is that if you built the largest optical telescope you could imagine -- even one that was the size of an entire planet -- you still wouldn't see the new cosmic record-holder that Hubble just discovered: galaxy GN-z11, whose light traveled for 13.4 billion years, or 97% the age of the universe, before finally reaching our eyes.

There were two special coincidences that had to line up for Hubble to find this: one was a remarkable technical achievement, while the other was pure luck. By extending Hubble's vision away from the ultraviolet and optical and into the infrared, past 800 nanometers all the way out to 1.6 microns, Hubble became sensitive to light that was severely stretched and redshifted by the expansion of the universe. The most energetic light that hot, young, newly forming stars produce is the Lyman- α line, which is produced at an ultraviolet wavelength of just 121.567 nanometers. But at high redshifts, that line passed not just into the visible but all the way through to the infrared, and for the newly discovered galaxy, GN-z11, its whopping redshift of 11.1 pushed that line all the way out to 1471 nanometers, more than double the limit of visible light!

Hubble itself did the follow-up spectroscopic observations to confirm the existence of this galaxy, but it also got lucky: the only reason this light was visible is because the region of space between this galaxy and our eyes is mostly ionized, which isn't true of most locations in the universe at this early time! A redshift of 11.1 corresponds to just 400 million years after the Big Bang, and the hot radiation from young stars doesn't ionize the majority of the universe until 550 million years have passed. In most directions, this galaxy would be invisible, as the neutral gas would block this light, the same way the light from the center of our galaxy is blocked by the dust lanes in the galactic plane. To see farther back, to the universe's first true galaxies, it will take the James Webb Space Telescope. Webb's infrared eyes are much less sensitive to the light-extinction caused by neutral gas than instruments like Hubble. Webb may reach back to a redshift of 15 or even 20 or more, and discover the true answer to one of the universe's greatest mysteries: when the first galaxies came into existence!

Images credit: (top); NASA, ESA, P. Oesch (Yale University), G. Brammer (STScI), P. van Dokkum (Yale University), and G. Illingworth (University of California, Santa Cruz) (bottom), of the galaxy GN-z11, the most distant and highest-redshifted galaxy ever discovered and spectroscopically confirmed thus far.



A Night at the Observatory by Ed Mizzi April 15, 2016

Another great night at the Observatory was had by all on Friday, April 15. I thought I would arrive early to get the roof rolled off and things set up, but when I arrived, two keeners, Mark Smith and Jen Hillier beat me to it, so thanks to them for getting things started.

In all, ten people participated in the event and, by all accounts, everyone had a fulfilling evening, with views of Jupiter, the Moon and a couple of deep sky objects. We were also treated to a flyby of the ISS at approx. 21:25, an event that never fails to amaze. In attendance, and besides myself, we had Muhammad Ahmad, Murray Romisher, Dave Dev, Jeff Booth, Connie Booth, Dilip Mahto, Martin Palenik, Mark Smith and Jen Hillier.

Besides the C14 and 16", a few people set up their own scopes. Martin had his very first telescope out, a nice refractor that gave us clear views of Jupiter. Mark had his Dob, Jeff his Celestron and Dave was doing some "sub" testing with his Sky Watcher Star Adventurer mount and DSLR. Muhammad also had a nice pair of binoculars we all shared. Mark and Muhammad also did some imaging with the C14 and got some good material.

Everyone who had not yet witnessed the mechanization of the roof were amazed, thanks to David S. And everyone stayed to help out with rolling the roof back on and cleaning up.

There was plenty of astro. talk going around and I'm sure that each and every person left the Observatory with new knowledge and an even deeper appreciation for this super hobby.

Photo by Muhammad Ahmad



Hamilton RASC April 7, 2016 Monthly Meeting SYNOPSIS from Ed Mizzi

Our April meeting was not only well attended but was one of the most diverse meetings we have experienced in recent times. Close to 40 members and guests were treated to a great guest speaker, several exciting club announcements and an on-the-road Armchair Astronomy simulation.

Gary Bennett starting things rolling with a summary of the night's activities. Here is a synopsis...

We began with our Membership Chairperson Bob Prociuk, who gave us an update of membership numbers and then asked any new members present to introduce themselves. As is our tradition, Bob presented each new person with a small astronomy grab bag and welcomed them to the club.

Gary Bennett displayed a slide describing the upcoming Transit of Mercury which occurs on May 9 of this year. He encouraged people to get out and witness this special event and also put out a general request to anyone willing the spearhead a group viewing.

- Gary then showed us a photo of the present condition of the club's 17.5 inch scope, which has been undergoing several repairs over the past several months. Gary's firm, Kendrick Astro Instruments, has generously taken on the job of completing the update. Stay tuned for further announcements.
- *Gary next discussed our Strategic Plan, what we have accomplished and where we go from here. Part of that plan involves working with the RBG on a project that could potentially see a state-of-the-art Planetarium built in Hamilton/Halton over the next several years. He also mentioned improvements that have been made to our Observatory and the C14 scope, but that there is still work to be done.
- Gary strongly encouraged members to take advantage of our Observatory, for both visual astronomy and astrophotography, as it is one of the best facilities in the area; and, in fact, one of few observatories owned by clubs in Ontario.
- Next came an Outreach Program update. Muhammad Ahmad reminded the members of the next official Observatory visual night, April 8 and encouraged everyone to attend. Gary B. added that we will be helping the RBG with their Spring program and the Hamilton Public Library's Fall program of spreading the good news about all things astronomy. He is looking for volunteers to help teach both beginner and advanced lessons to the public.
- Gary next brought up AstroCATS and how exciting it will be this year, especially because it is teamed up with the RASC General Assembly in London and a brand new CAPS (Canadian Astrophotography School). He is asking for a total of 20 volunteers to help run AstroCATS in May.
- Gary then introduced Bert Rhebergen, a long-time and very dedicated member, who briefly discussed a special sky event and passed around an interesting photo of it.

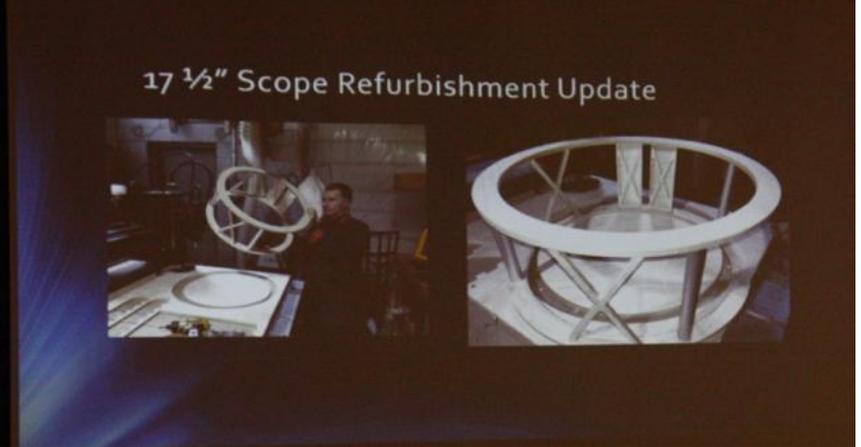
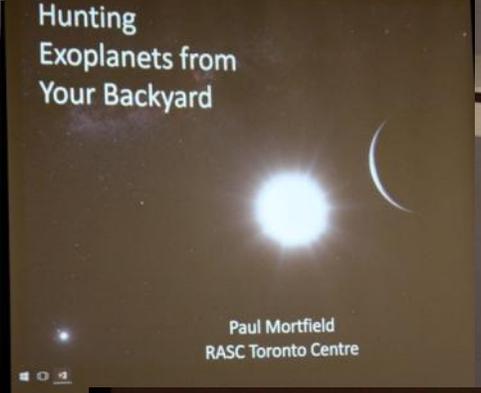
We were next treated to a fascinating talk about Exoplanets by Paul Mortfield of the RASC Toronto Centre. His presentation was entitled "Hunting Exoplanets from Your Backyard" and he explained, using several interesting slides, how you, too, could find exoplanets with amateur equipment, even if it means simply spotting those that have already been discovered. The Hunt is on!!!

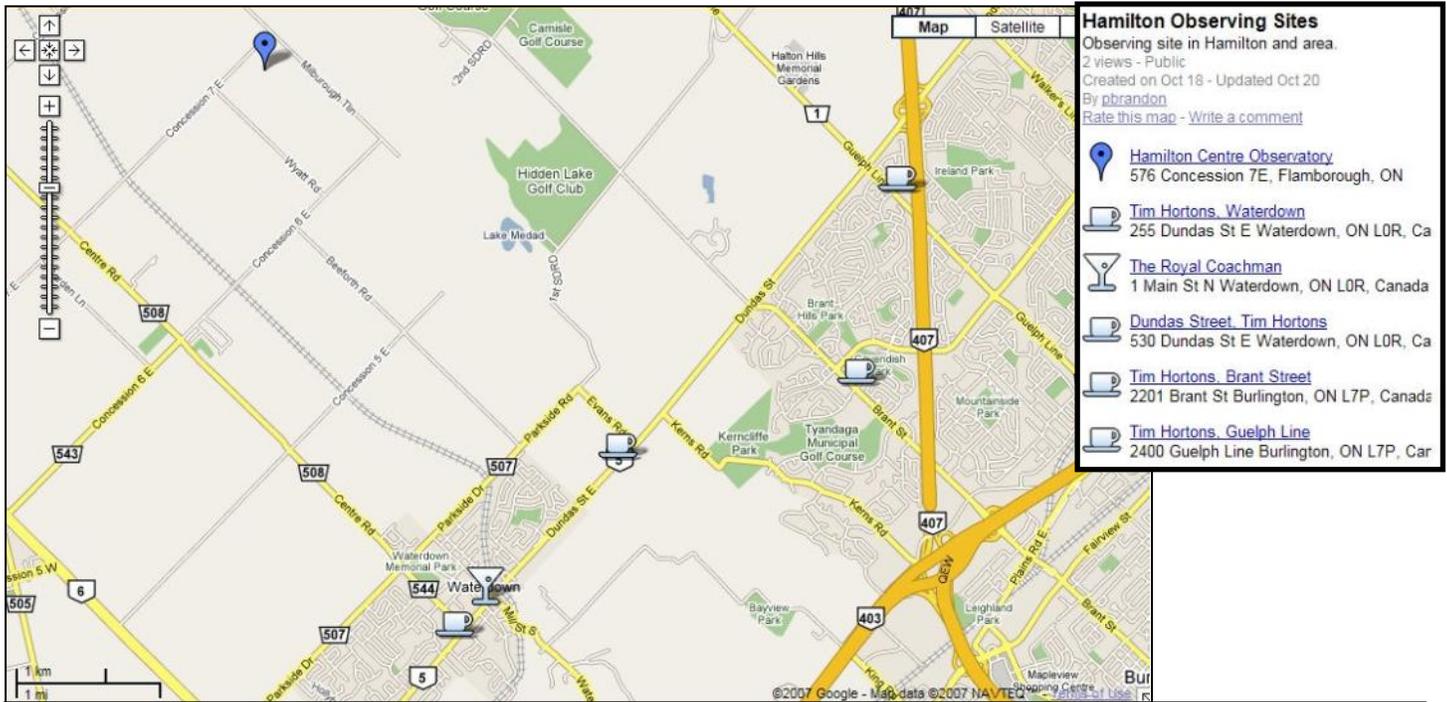
When Paul was finished, David Surette took the floor, and introduced the first ever Monthly Meeting version of Armchair Astronomy. David's goal was to encourage members to join with him on the first Monday of each month, at the Observatory, in one of the many fascinating discussions that ensue on those evenings. So he introduced the topic with a short discussion about early astronomers and how brilliant they were, even though much of their work was "naked eye" astronomy with not much technology at their disposal. He also mentioned the vast array of technology we now have at our disposal, from GO TO telescopes to smart phone apps that tell you what's in the night sky at any given time or place. He then invited the audience members to weigh in on what is more important and/or useful...technological devices such as GPS units, Smart Phones with planetarium apps and the like, OR, learning the night sky using star charts, books and other visual aids that allow hobbyists to find celestial objects and share those skills and that knowledge with others.

There was a 20 minute limit on the discussion and during that time no fewer than 10 people gave their opinions and rationale for either or both sides of the argument, and I am certain the discussion could have gone well into the night. So for those who were in attendance and other members reading this, you would be denying yourselves a very enjoyable evening by not coming out to Armchair Astronomy where the topics are endless, the discussion engaging and the comradery memorable.

Gary Bennett adjourned the 2 hour meeting and invited people to join him at the Royal Coachmen for refreshments.

Thank you to all who attended and participated. A special thank you to our guest speaker, Paul Mortfield. Also thanks to Bill Leggitt for bringing the screen, projector and grab bags for new members. Hope to see you next month.





Observatory:

576 Concession 7 East,
 Flamborough ON
 N43° 23' 27" W79° 55' 20"

Mailing Address:
Hamilton Centre, RASC

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|----------------------|------------------|
| President | Gary Bennett |
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| Webmaster | John Devonshire |
| Youth Outreach | Ed Mizzi |

Mercury transits the Sun on May 9.

Venus is too close to the Sun to be observed.

Mars is in opposition to the Sun on May 22, and closest to Earth on May 30. This is generally a good apparition, but Mars is low in the southern sky for northern observers. It is visible all night in Scorpius.

Saturn is well placed in Ophiuchus, rising in late evening. Its rings are now spread widely, making it a beautiful sight in a small telescope.

Calendar for May, 2016

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 - Week 18	2 Events: Armchair Astronomy at the Observatory	3	4	5 Events: 8pm at the Waterdown Legion	6 New Moon	7
8 - Week 19	9 Events: Transit of Mercury	10	11	12	13 First Quarter Events: Outreach at Westfield	14
15 - Week 20	16	17	18	19 Events: Canadian Astro Photography Schools (CAPS)	20 Events: Canadian Astro Photography Schools (CAPS)	21 Full Moon Birthdays: SubOrbitalRoger (61) Events: AstroCATS
22 - Week 21 Events: AstroCATS	23	24	25	26 Events: Astrophotography at the Observatory	27	28
29 - Week 22 Last Quarter	30	31				